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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/608,855	06/27/2003	Francesco Ciovacco	2110-47-3	8247

7590 07/06/2005  
GRAYBEAL JACKSON HALEY LLP  
Suite 350  
155-108th Avenue N.E.  
Bellevue, WA 98004-5973

EXAMINER

NADAV, ORI

ART UNIT PAPER NUMBER

2811

DATE MAILED: 07/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/608,855

Applicant(s)

CIOVACCO ET AL.

Examiner

Ori Nadav

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-53 is/are pending in the application.
- 4a) Of the above claim(s) 7, 12, 13, 16-18, 23, 34-40 and 50-53 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8-11, 14, 15, 19-22, 24-33 and 41-49 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                                    | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Claim Objections***

Claim 11 is objected to because of the following informalities: The phrase "chosen in the group" should read "chosen from the group". Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 2-6, 8, 15, 20-22, 24-31, 41-44 and 46 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed limitations of varying an etching voltage between said plasma and said wafer, as recited in claims 2, 24 and 46, are unclear as to how an etching voltage can vary between a condition (plasma) and a physical location (wafer).

The claimed limitations of removing portions of the substrate by parts in series, and depositing a second polymeric film on the walls by pads in series, as recited in claim 24, are unclear as to what is meant by "removing/depositing...parts in series".

The claimed limitation of oblique profile having approximately the same angle, as recited in claim 45, is unclear because applicant does not recite "the same angle as which". Does applicant mean "an oblique profile having approximately a constant angle?"

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 9, 14-15, 19-21 and 45-47, insofar as in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 102(b) as being anticipated by Chen et al. (5,807,789).

Chen et al. teach in figures 4-6 and related text a process for forming trenches with an oblique profile and rounded top corners, comprising the steps of:

through a first polymerizing etch, forming in a semiconductor wafer depressions delimited by rounded top corners (column 2, line 55); and

through a second polymerizing etch, opening trenches at said depressions; characterized in that said second polymerizing etch is performed in variable plasma conditions (column 2, line 60 to column 4, line 18), to form trenches with oblique profiles having a substantially constant slope,

wherein said step of forming said second polymerizing etch comprises varying an etching voltage between said plasma and said wafer,

wherein said step of varying comprises increasing said etching voltage,

wherein said second polymerizing etch is an HBr- and O<sub>2</sub>-based etch,

wherein said step of forming a first polymerizing etch and said step of forming a second polymerizing etch are performed using a masking structure,

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wherein the process comprises the step of filling said trench with a dielectric material.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4-6, 8, 10-11, 19-22, 24-33, 41-44 and 48-49, insofar as in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al.

Chen et al. teach substantially the entire claimed structure, as applied to claim 1 above, except an etching voltage being a discrete-ramp voltage of steps of constant duration of approximately 30 seconds. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an etching voltage being a discrete-ramp voltage of steps of constant duration of approximately 30 seconds in Chen et al.'s device in order to obtain the best device characteristics, based on routine experimentation and optimization.

Regarding claims 8 and 24, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to place Chen et al.'s wafer in an etching

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chamber and to supply a constant chamber voltage thereto, in order to form the device in a known processing location (an etching chamber).

Regarding claims 10-11, 22 and 26, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use  $\text{Cl}_2$  and  $\text{N}_2$  and a substance chosen in the group comprising  $\text{CHF}_3$ ,  $\text{CH}_2\text{F}_2$  in the polymerizing etch in Chen et al.'s device, in order to improve the etching steps of making the device.

Regarding claims 10-11, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to fill Chen et al.'s trench with a dielectric material in order to form the device as taught by Chen et al.

Regarding claims 32-33, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to fill Chen et al.'s trench with a silicon oxide by CVD, in order to simplify the processing steps of making the device by depositing a known dielectric material in a conventional deposition method.

Regarding claims 24-25, 27-31 and 44, Chen et al. teach filling the chamber with a plasma mixture of gases; setting the temperature, pressure and gas flow; setting a chamber voltage; setting a series wafer voltages; creating a series of etching voltages between the substrate and the plasma; removing portions of the substrate by parts in series; and depositing a second polymeric film on the walls by pads in series, wherein

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the plasma mixture of gases comprises mixing hydrogen bromide and oxygen, wherein a rate of depositing the second polymeric film increases as the absolute value of the etching voltages increase, wherein depositing the second polymeric film further comprises controlling the growth of the walls of the trench by the series of etching voltages, wherein creating a series of wafer voltages further comprises setting the wafer voltage to 10 volts for a first thirty seconds, setting the wafer voltage to 20 volts for a second subsequent thirty seconds, and setting the wafer voltage to 30 volts for a third subsequent thirty seconds, exposing decreasing portions of the wafer; and keeping a slope of the walls of the trench substantially constant, wherein the slope the walls is at an angle between sixty-five and eighty-five degrees to a vertical, wherein the steps have different durations.

Regarding claims 41-43, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a non-uniform voltage step function being a discrete parabolic voltage function and a continuous parabolic voltage function in Chen et al.'s device in order to improve the device characteristics by using routine experimentation and optimization.

### ***Response to Arguments***

Applicant argues that the claimed limitation of varying an etching voltage between plasma and wafer is clear, because plasma is not a condition, but a state of matter.

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Applicant recites in claim 1 "plasma conditions", wherein an etching voltage can vary between "said plasma" and the wafer (claim 2). Clearly, "plasma" describes a processing condition of making the device and not a physical element in the structure made. Therefore, the claimed limitation of varying an etching voltage between plasma and wafer is unclear.

Applicant argues that Chen et al. do not teach trenches with oblique profiles having a substantially constant slope.

The broad recitation of the claim does not require the trenches to have a substantially constant slope through the entire trench sidewall. Clearly, parts of the sidewalls of Chen et al.'s trench have a substantially constant slope. Therefore, Chen et al. teach trenches with oblique profiles having a substantially constant slope, as claimed.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Loke can be reached on 571-272-1657. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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A handwritten signature in black ink, appearing to read 'Ori Nadav', with a stylized, sweeping flourish at the end.

O.N.  
6/30/05

ORI NADAV  
PRIMARY EXAMINER  
TECHNOLOGY CENTER 2800